



Faculty of Manufacturing Engineering

**LEAN - ENVIRONMENTAL MANAGEMENT SYSTEM INTEGRATION
MODEL**

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DECLARATION

I declare that this thesis entitle “Lean - Environmental Management System Integration Model” is the result of my own research except as cited in the references. This thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : SURESH A/L VASU

Date :

DEDICATION

To my beloved mother, father, brother, sisters, my future wife, aunty, uncle and friends

ABSTRACT

Environmental management system (EMS) is a tool for managing the impact of an organization's activities on the environment. The most well-known EMS model is ISO 14001. ISO 14001 is touted as the most successful global environmental standard which provides the framework to control and reduce impact on the environment. Although the standard believed to be one of the best environmental management model, there are studies reveal that industries are currently facing a number of challenges to maintain competitiveness, productivity and minimal environmental impact. Besides that, studies also shows that the standard lack of guidelines to accomplish "continuous improvement" element, operational definition on continuous improvement and method to assess it. This turns to be the main factor influence the standards sustainability. Lean is a tool for process improvement focusing on key processes that affect the output to the customer and focuses on continuously improving the process management elements. Lean pushes for continuous improvement and empowers companies to better their environmental performance. The purpose of this study is to integrate lean principles with ISO 14001 standard to achieve sustainability through continuous improvements. Three objectives were identified to achieve this purpose. First objective, identify both system's characteristic through literature review and questionnaire survey, then continue with the second objective, find the linkages between both system and develop an integration model and finally the third objective, validate the model using focus group. This study uses combination of qualitative and quantitative research methodology. Reliability test and descriptive statistics using statistical package of the social science software were used to record, analyze and interpret the raw data. Finding shows that there is positive correlation between both systems; as a result, new model called Lean Environmental Management Integration System (LEMIS) has been developed. The model creates measurement standards for evaluating the organization, making its environmental efforts more realistic, focused and attainable. The model's validation results shows that by integrating the standard with Lean principles through LEMIS model helps to specify the performance measures and leads the standard to achieve sustainability and continuous improvement. This study presents a unique approach of integrating the two main models as a single framework benefiting contemporary organizations. The study concludes by stating that more case studies in this direction are required to be conducted for examining the feasibility of amalgamation and implementing ISO 14001:2004 standards with the philosophy of Lean Principles to enable the achievement of world class standards.

ABSTRAK

Sistem pengurusan alam sekitar (EMS) merupakan sistem yang menguruskan kesan daripada aktiviti organisasi terhadap alam sekitar. Model EMS yang paling terkenal adalah ISO 1400. ISO 14001 adalah dianggap sebagai standard alam sekitar global yang paling berjaya yang menyediakan rangka kerja untuk mengawal dan mengurangkan kesan terhadap alam sekitar. Walaupun standard tersebut dipercayai sebagai salah satu model pengurusan alam sekitar terbaik, ada kajian menunjukkan bahawa industri kini menghadapi beberapa cabaran untuk mengekalkan daya saing, produktiviti dan kesan alam sekitar yang minimum. Selain itu, kajian juga menunjukkan bahawa standard kekurangan garis panduan untuk mencapai elemen "peningkatan berterusan", definisi operasi pada penambahbaikan dan kaedah untuk menilai standard secara berterusan. Ini bertukar menjadi faktor pengaruh utama untuk mengekalkan standard tersebut. Lean merupakan system penambahbaikan proses yang memberi tumpuan kepada proses-proses utama yang memberi kesan kepada pelanggan dan meningkatkan elemen-elemen pengurusan proses. Lean merangsang untuk penambahbaikan yang berterusan dan membantu syarikat-syarikat untuk memperbaiki prestasi alam sekitar mereka. Tujuan kajian ini adalah untuk mengintegrasikan prinsip Lean dengan standard ISO 14001 untuk mencapai kemampanan melalui penambahbaikan yang berterusan. Tiga objektif telah dikenal pasti untuk mencapai tujuan ini. Objektif pertama, mengenal pasti ciri kedua-dua sistem melalui kajian literatur dan kajian soal selidik, objektif kedua, mencari hubungan antara kedua-dua sistem dan membangunkan model integrasi dan akhirnya objektif ketiga, mengesahkan menggunakan kumpulan fokus. Kajian ini menggunakan gabungan kaedah penyelidikan kualitatif dan kuantitatif. Ujian "reliability" dan statistik deskriptif menggunakan pakej statistik perisian sains sosial telah digunakan untuk merekod, menganalisis dan mentafsir data. Hasil kajian mendapati, terdapat hubungan positif antara kedua-dua sistem; hasilnya, model baru yang sebagai sistem integrasi lean dan pengurusan alam sekitar (LEMIS) telah dibangunkan. Model ini membantu menilai organisasi, membuat usaha alam sekitar yang lebih realistik, fokus dan mudah dicapai. Keputusan pengesahan model menunjukkan bahawa model LEMIS membantu untuk menentukan langkah-langkah prestasi dan membawa standard untuk mencapai kemampanan dan penambahbaikan yang berterusan. Kajian ini memperkenalkan satu pendekatan yang unik dengan mengintegrasikan kedua-dua model utama sebagai rangka kerja tunggal memberi manfaat kepada organisasi kontemporari. Kesimpulan dari kajian ini mendapati, bagi membolehkan pencapaian standard bertaraf dunia, kajian kes yang lebih ke arah kajian ini perlu dijalankan untuk memeriksa kemungkinan penyatuan dan melaksanakan standard ISO 14001:2004 dengan falsafah Prinsip Lean.

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LIST OF ABBREVIATIONS

CIP	-	Continuous Improvement Process
CSF	-	Critical Success Factor
EM	-	Environmental Management
EMS	-	Environmental Management System
EMAS	-	Eco-Management and Audit Scheme
GATT	-	General Agreement on Tariffs and Trade
IEMA	-	Institute of Environmental Management and Assessment
ISO	-	International Organization for Standardization
IMS	-	Integration Management System
JIT	-	Just In Time
LEMIS	-	Lean –Environmental Management Integration System
PDCA	-	Plan-Do-Check-Act
QMS	-	Quality Management System
SPSS	-	Statistical Package of The Social Science
TPS	-	Toyota Production System
TPM	-	Total Preventive Maintenance
TQM	-	Total Quality Management
VSM	-	Value Stream Mapping

LIST OF PUBLICATIONS

Journals

Puvasvaran, A. Perumal, Robert Kerk Swee Tian, Suresh Vasu and Mohd Razali Muhamad, 2012. Integration Model of ISO 14001 With Lean Principles. *American Journal of Applied Sciences*, Vol. 9, No. 12, pp. 1974-1978.

Puvasvaran, A. Perumal, Robert Kerk Swee Tian, Suresh Vasu, Mohd Razali Muhamad, 2012. Lean principles adoption in environmental management system (EMS): A survey on ISO 14001 certified companies in Malaysia. *Journal of Industrial Engineering and Management*, Vol. 5, No. 2, pp. 406-430.

CHAPTER 1

INTRODUCTION

1.1 Background of study

Managing environmental performance has been viewed as a strategic issue by many companies worldwide, primarily because the environment is now regarded as an asset to be valued. As a result, managers today are not only expected to reduce lead times, improve quality, reduce costs and enhance flexibility but they are also expected to become more environmentally responsible (Montabon et. al., 2000). The International Organization for Standardization (ISO) introduced the ISO 14000 series of standards in 1996 as a response to urgent need for companies to address the impact of enterprises' activities on the environment issues.

ISO 14001 is the world's most recognized environmental management system (EMS) framework that helps the organizations to improve the impact of their both activities on the environment and also to demonstrate sound environmental management. ISO 14001 is designed to be flexible enough to be applied to any size of organization in both the private and public sectors. ISO 14000's EMS standards are known as process standards without involving the performance standard. Instead, this standard describes a system that will improve an organization to achieve its own objectives and targets. Based on the standards performance, an assumption has been made where by improving the environmental management will indirectly lead to a better environmental performance. ISO 14001 defines continual improvement as "a process of enhancing the environmental management system in order to achieve improvements in overall environmental

performance consistent with the organization's environmental policy' by ISO 14001 (ISO, 2004).

ISO 14001 describes the criteria for developing an environmental management system (EMS). An environmental management system (EMS) is essential as a part of the overall management system that includes organizational structure, planning, activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy (ISO, 2004). EMS helps an organization to enhance the full scope of environmental considerations and improved the results by establishing a continuous process of checking to confirm environmental goals are met. The framework is based on a plan-do-check-act continual improvement approach that leads an organization through a regular cycle of planning, implementation, performance monitoring and review or improvement. An environmental management system (EMS) is a structured approach to address the environmental bottom line. The description shows that improvement in environmental performance is the ultimate touchstone for continual improvement. Moreover, the description also suggests that such improvements are based on enhancement of the environmental management system itself.

Environment management systems have been used as focal point of management strategies in most organizations today. EMS practices within an organization need to be integrated with existing organizational practices to identify its true potentials. Research studies have been revealed that the majority of organizations focus more on gaining market competitive advantage, improving customer relations, and increasing profit potentials than adopting work processes that satisfy environmental safety and policy requirements (Puvanasvaran et. al., 2011).

Meanwhile, Lean is known as business model that focuses on delivering quality products to the customer by reducing cost of production. The principles of Lean are founded on understanding of customer needs and demands, eliminating non-value added activities from the production process, involving the workforce in resolving operational issues, define metrics for measuring organizational performance, assist in the decision making process and problem solving (Ross, 2004).

Besides, Lean manufacturing focuses on eliminating waste from organizational processes with a view to deliver more value to a customer. Thus, integrating Lean with the ISO 14001 standard will make the standard more sustainable because it will be customer-oriented which is consistent with the objectives of many organizations (Simpson and Power, 2005; Shah and Ward, 2007). Implementing Lean principles requires an organization to identify all the processes that are involved in the conversion of raw materials into a finished product for the customers. This process is known as mapping the value stream. Integrating Lean with ISO 14001 standard ensures that the environmental impact of all processes leading to the product delivery to customers are identified and dealt effectively (Sroufe, 2003; Montabon et. al., 2007). This will lead to a higher environmental performance of organizations.

Lean principles also emphasize on perfection which is achieved through continuous learning and improvement. These two aspects can also be applied to the ISO 14001 standard so that environmental outcomes of an organization are enhanced as an organization learns to improve the management of the standard impact on the environment (Zhu and Sarkis, 2004; Kleindorder et. al., 2005). The principles also advocate for production based on customer demand so that there is no unnecessary production. This is an important concept in reducing avoidable environmental emissions. Puvanasvaran et. al., (2011) also mentioned that effectiveness of integrating Lean and EMS can be realized by

adopting processes and procedures which are designed to eliminate waste and create an economically sustainable work environment.

1.2 Problem Statement

Many organisations are under pressure to demonstrate their performance on management of the environmental impacts on their business activities responsibly and effectively (Hall, 2000). Zutshi and Sohal (2004) in their study mentioned that industries are currently facing a number of challenges to maintain competitiveness and productivity while at the same time creating a minimal environmental impact. Due to this, many organisations are considering the implementation of an environmental management system (EMS) within this climate of pressure, growing trend towards more responsible corporate governance and also environmental awareness.

Environmental Management System (EMS) is defined as the part of the overall management system (ISO 14001:2004). The most well-known EMS model is ISO 14001. ISO 14001 sets the criteria for an EMS and it enables EMS to dictate the environmental requirements and needs of an organization. Rao (2005) has mentioned that an EMS is not a stagnant system but continually evolve system to meet an organization's ever-changing needs. ISO 14001 is voluntary based standard and there are no any legal requirements to certify on this standard. Voluntary standards are usually seen to be ineffective since its implementation depends on management incentives which lead to less than optimal performance by organizations on the environmental sustainability front (Pojasek, 2008).

Ghisellini and Thurston (2005) argued that ISO 14001 is a “management” standard, and not a “performance” standard where the commitment to continuous improvement is intended to be applied to the Environmental Management System itself but

not in the actual environmental performance. Zutshi and Sohal (2004) have also argued that ISO 14001 lack of guidelines to accomplish “continuous improvement” element. In support to Zutshi and Sohal argument Martin and Koppen (2006) also have mentioned that ISO 14001 standard lacks of an operational definition on continual improvement and method to assess it.

Besides that, Pojasek (2006) also have mentioned that the ISO 14001 standard lack of detailed guidance on the implementation, which has resulted in procedures that are not clear and reproducible. Meanwhile, Pullin (1998) argued that the ISO14001 standard blocks the way for other routes that might deliver real performance improvements and sustainable industrial development since ISO 14001 talks about “standardization in the field of environmental management tools and systems”.

This clearly indicates that ISO 14001 did not specify the guidelines or operational definition of what continual improvement is and how it is accomplished or assessed. It also indicates that many organizations are struggling to sustain their environmental management system due to lack of proper guidance on the system sustainability (Pojasek, 2008). As result, this study intent to integrate lean principles into ISO 14001 in order to specify this limitation. Since lean is a powerful force for process improvement, it will generates the most value when it is linked to programs that create a demand for continual improvement (Pojasek, 2008). Hence, the study will enable to open new exploration regarding the relationship of the ISO 14001 and lean, with the same objectives, goals and use. These two factors are vital because of the current changes and development in the business and manufacturing procedures, particularly in the aspect of cost effectiveness and the issue related to the environment.

1.3 Objective of Study

The main objective of this study is to integrate ISO14001 Standards and Lean principles.

Specific objectives are:

1. To identify the characteristic of ISO 14001 standard clauses and core elements of lean principles through literature review and questionnaire survey.
2. To develop Lean - Environmental Management System (EMS) integration model by identifying the linkage between ISO 14001 Clauses and lean principles core elements.
3. To validate the Lean - Environmental Management System (LEMIS) integration model using focus group methodology.

1.4 Scope of the study

Explore and understand the characteristics of ISO 14001 standard clauses and core elements of lean principles by referring to past studies and literature. Survey will be carried out on ISO 14001 certified companies in Malaysia to determine whether Lean Principles can help a business organization to improve its continual improvement by implementing the ISO 14001 standard. Individual that involved with the ISO 14001 in their respective company will be the respondent of the questionnaire survey. Focus group validation will be carried out to validate the Lean-EMS models. Experts in related field will be invited to review and validate the integration model.